

Creating Assemblies

I-DEAS™ Tutorials: Fundamental Skills

Learn how to:

- create an assembly hierarchy
- identify the differences between instances and parts
- move instances without constraints
- constrain instances
- duplicate instances
- check an assembly into a library

Before you begin...

Prerequisite tutorials:

1. Introducing the I-DEAS™ Interface
—or—
Quick Tips to Using I-DEAS
—and—
Creating Parts
2. Managing Parts in Model Files
3. Using Libraries with Full I-DEAS Data Management

Make sure you're in the following application and task:

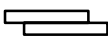


Design or Simulation



Modeler

Open a new model file and name it AssemblyLesson.



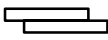
File

Open



Name: AssemblyLesson

Set your units to mm.



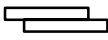
Options

Units



mm (milli newton)

Save your model file.



File

Save

Warning!

If you are prompted by I-DEAS to save your model file, respond:



No

Save only when the tutorial instructions tell you to—not when I-DEAS prompts for a save.

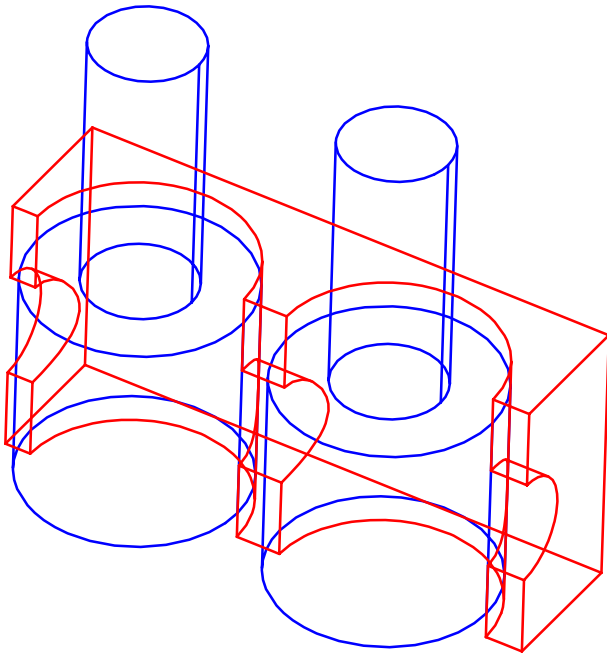
If you make a mistake at any time between saves and can't recover, you can reopen your model file to the last save and start over from that point.

Hint

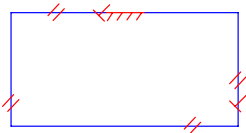
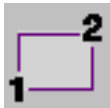
To reopen your model file to the previous save, press Control-z.

The scenario used in this tutorial is a model of a flow control valve assembly. To make it easy to understand the assembly concepts, the geometry will be simplified, and only one half of the valve block will be used.

To start building the assembly, follow the instructions given on the next few pages.

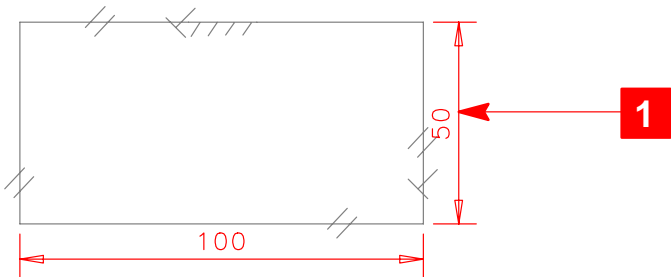


Sketch a rectangle to be used to create the valveblock.



Modify the dimensions of the rectangle to the values shown.

1 pick one dimension



Dimensions form



select smaller (vertical) dimension

50



select larger (horizontal) dimension

100

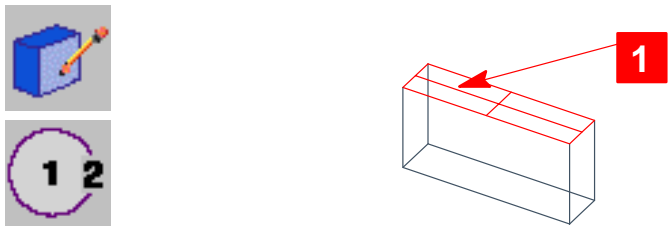


OK

Extrude the rectangle using a value of 25mm.



Sketch two circles on the edge of the top face of the block.



Options...

Circle by Center and Edge Options form



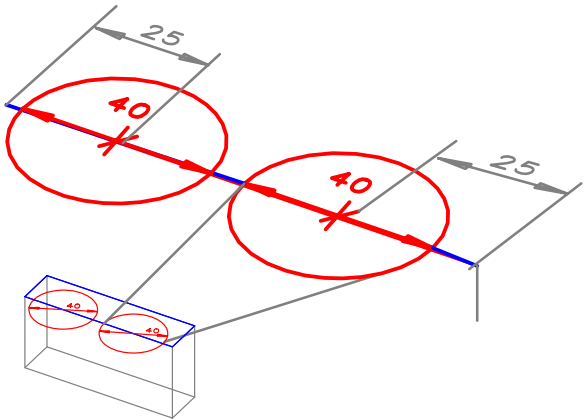
Radius: 20



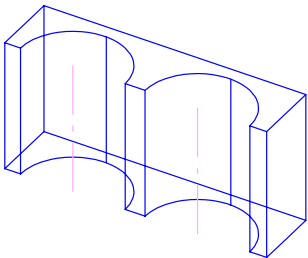
OK



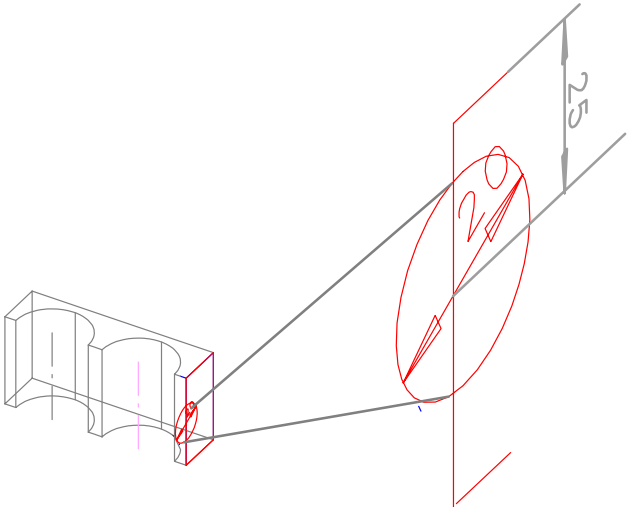
Do not overlap the circles, and be sure to center the circles on the edge of the block.



Extrude the circles (*Cut, Value: Thru All*) through the block.



Following the same steps, sketch a circle on the side face of the valveblock.



Options...

Circle by Center and Edge Options form

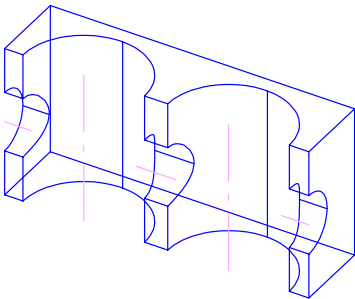


Radius: 10



OK

Extrude the circle (*Cut, Value: Thru All*) through the block.



Create a bin named “flowvalve” to store the new part.
Name the part “valveblock.”



Recovery Point

 *File*
Save

Sketch a circle, to the dimension shown, on the workplane above the valveblock.



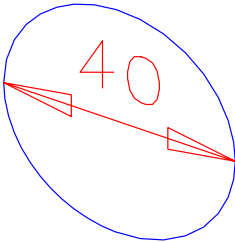
Options...



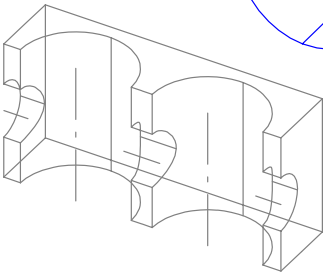
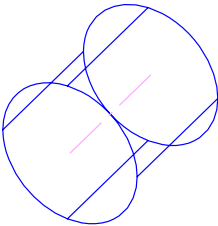
Radius: 20



OK



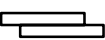
Extrude the circle 40mm to create a piston.



Name the part “piston.”



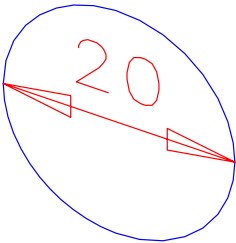
Recovery Point



File

Save

Sketch another circle on the workplane.



Options...

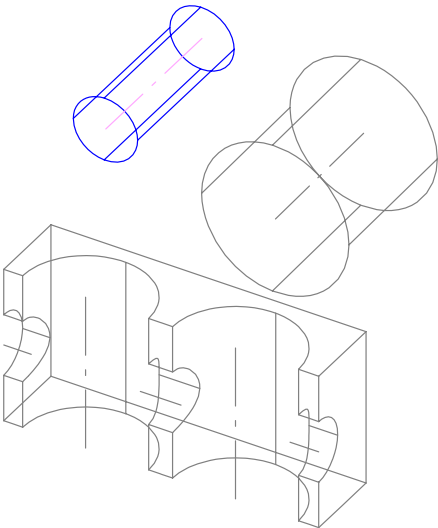


Radius: 10



OK

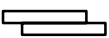
Extrude the circle 50mm to create a pushrod.



Name the part “pushrod.”



Recovery Point



File
Save

An assembly is a modeling entity that combines parts into a hierarchical product structure. You can assemble any collection of parts from the workbench, bins, and libraries.

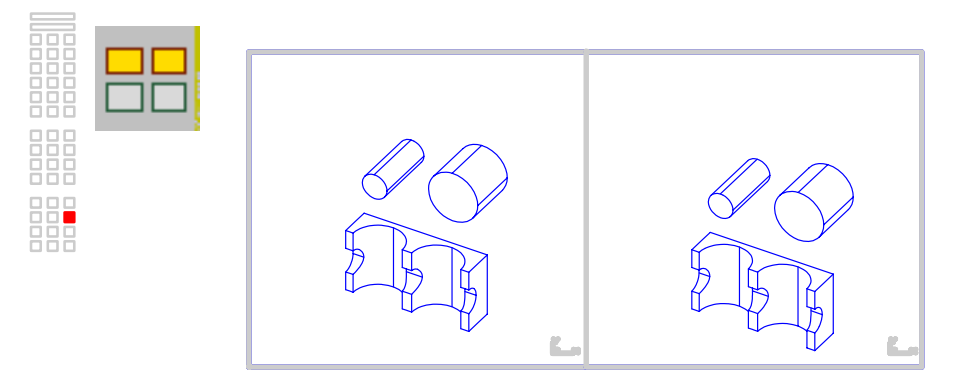
An assembly hierarchy is a way to organize the collection of parts.

A part contains geometry definition and other attributes such as color and mass properties.

An **instance** in an assembly is not a copy of a part; it is like a “virtual image” of the part used in the assembly. An instance refers back to the part (stored in the bin) for its geometry definition and other attributes. Because an instance only displays the part in different locations in an assembly, without storing multiple copies of the geometry, it more efficiently uses data storage than if you made multiple copies of the part.


In this section you will learn how to create an assembly hierarchy using the parts you’ve just created. You will use two viewports to help explain the differences between parts and instances.

Open two viewports on your workbench. You will use one viewport to display parts and the other viewport to display assemblies, to help demonstrate their differences.

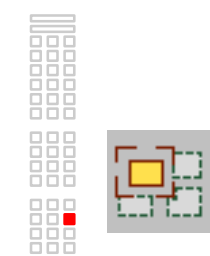


Things to notice

You now have two views of the same three parts on the workbench. Each is a view of the same workbench, but is independently controlled.

 Use the *Work Viewport* icon to define the active viewport so you can use the view icons, such as isometric view or zoom all.

Hint



click in the viewport where you want to use other view icons

Use display filters to change the display options in the viewports.

Set the left viewport (viewport 1) to display parts on the workbench. Set the right viewport (viewport 2) to display assembly instances.



Display Filter form

☒ *Viewport 1*

☒ *Parts...(toggle on)*

☐ *Assembly... (toggle off)*

☐ *Apply*

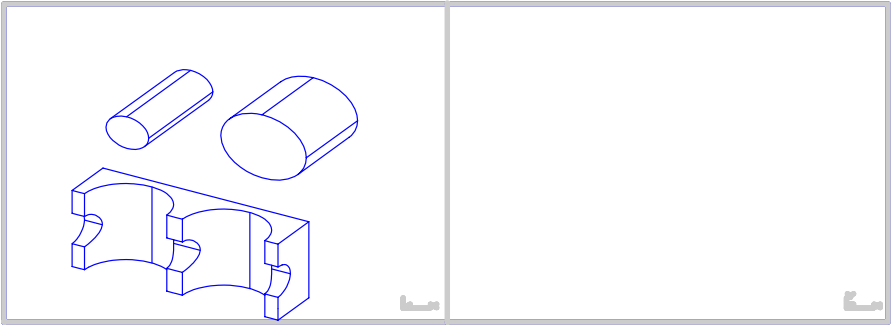
☒ *Viewport 1*

☐ *Parts...(toggle off)*

☒ *Assembly...(toggle on)*

☐ *Apply*


☐ *OK*




Things to notice

The parts are now displayed only in viewport 1.

When you create the assembly later in the tutorial, the instances will be displayed in viewport 2.

 Normally, you may not want to work with two viewports. Using them now better demonstrates when parts become instances in an assembly.

 Do not continue if your graphics display is not like the one above. If it is different, make sure you set your display filters correctly (previous page).

Recovery Point

 *File*
Save

Switch to the Assembly task.



Modeler
Assembly

Pick the *Hierarchy...* icon to begin creating an assembly.



Hierarchy form

(click icon on form)



Name form

Name: Piston Assembly



OK



Do not dismiss the Hierarchy form.

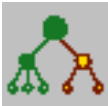
Add the piston and pushrod into the Piston Assembly.

Hierarchy form

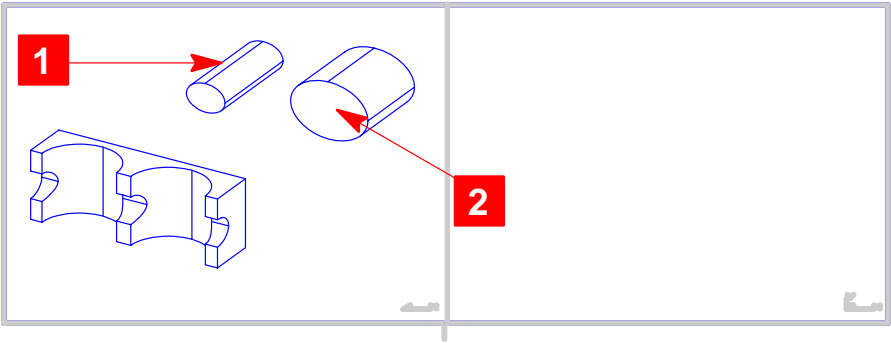


Piston Assembly (select)

(click icon on form)



- 1 pick anywhere on pushrod
- 2 shift-pick anywhere on piston



(Done)

Things to notice

The pushrod and piston are now listed on the form under the Piston Assembly.

Hierarchy form



Dismiss



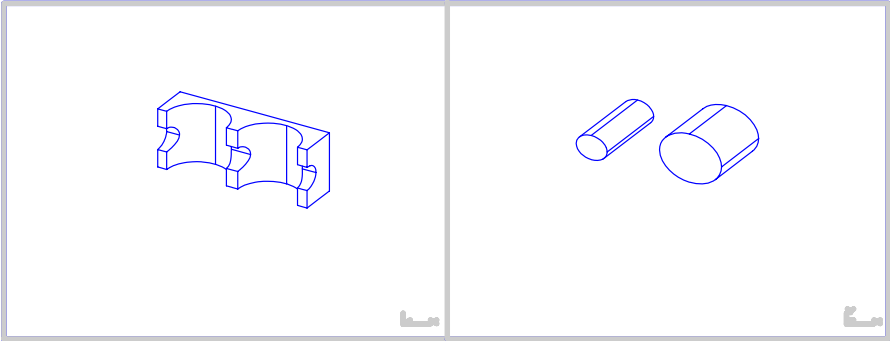
Deselect All

Things to notice

The piston and pushrod are now instances in the assembly, and the parts were automatically put away in the bin.

part on workbench

instances in assembly



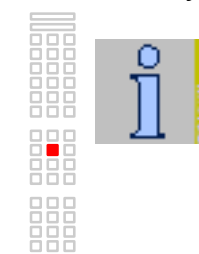
viewport 1

viewport 2



Remember that both viewports are displaying the same workbench. However, viewport 1 is filtering out the assembly instances, and viewport 2 is filtering out the parts.

Check information on the workbench and verify that there is only one part listed on the workbench.



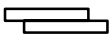
Workbench



Check I-DEAS List.

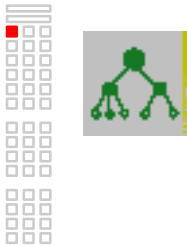
Verify that there is only one part on the workbench (the valveblock). The piston and pushrod parts have been put away in the bin. The assembly is also on the workbench, as shown in viewport 2.

Recovery Point



*File
Save*

Add a parent assembly above the Piston Assembly and name it “Valve Assembly.”



Hierarchy form

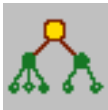


Piston Assembly (select)

Things to notice

When you select Piston Assembly on the form, the entire assembly is highlighted.

(click icon on form)



Name form

Name: Valve Assembly

OK



Do not dismiss the Hierarchy form.



In this tutorial you will build your assembly from “the bottom up.” In a real design, you may choose to work from “the top down” by building empty subassemblies and adding part instances to them.

Add the valveblock to the Valve Assembly.

Hierarchy form

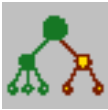


Valve Assembly (select)

Things to notice

When you select Valve Assembly on the form, the entire assembly is highlighted.

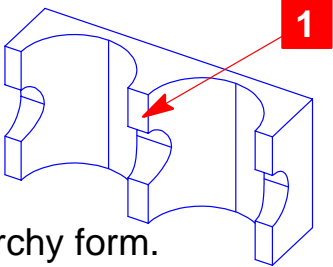
(click icon on form)



1 pick anywhere on the valveblock



(Done)



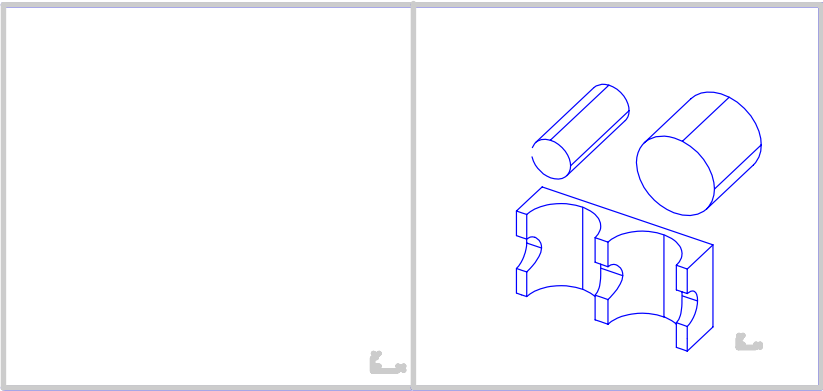
Do not dismiss the Hierarchy form.

Things to notice

All of the parts are now instances in the assembly. The assembly *Hierarchy* form should now read:

- Valve Assembly
 - valveblock
- Piston Assembly
 - piston
 - pushrod

Hierarchy form



Check the information on the workbench. There should be no parts listed there.



Recovery Point



Identify the differences between instances and parts

1 of 4

As you just saw when you added parts to the assembly, two things happened:

- instances of the parts were created
- the original parts were put away in the bin

An instance of a part is not a duplicate of the part. It is a representation of the part that is stored in the bin. If you make any changes to the part, all of the instances of the part will change.

However, an instance does contain new information on top of the geometry of the part being displayed. For example, each instance contains its own orientation information, allowing instances of the same part to be used in different locations in space.

Identify the differences between instances and parts

2 of 4

Get the three parts out of the bin so that you'll have both parts and instances on your workbench.



Get form



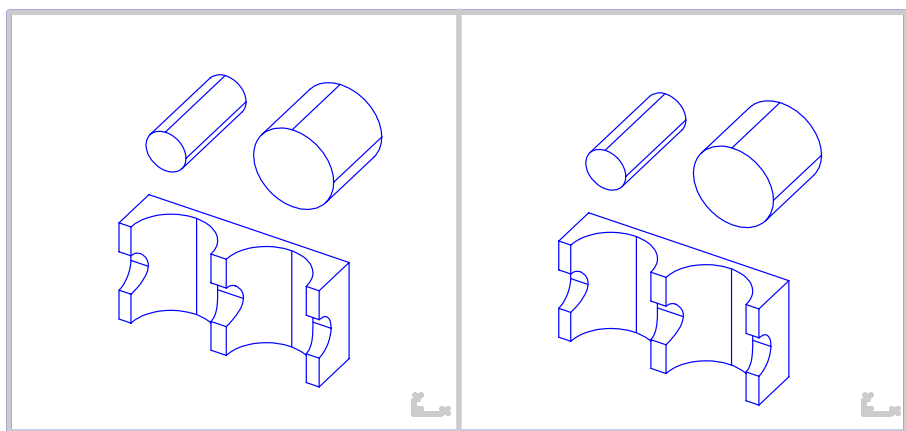
piston

pushrod (Control-pick)

valveblock (Control-pick)



OK



Things to notice

Even though the viewports look the same, only instances are displayed in viewport 2, and only parts in viewport 1.

Remember

You set your display filters so you could view parts in viewport 1 and assemblies in viewport 2.

Identify the differences between instances and parts

3 of 4

Notice the differences in the message in the *I-DEAS List* region when you select a part in viewport 1 compared with selecting an instance in viewport 2.

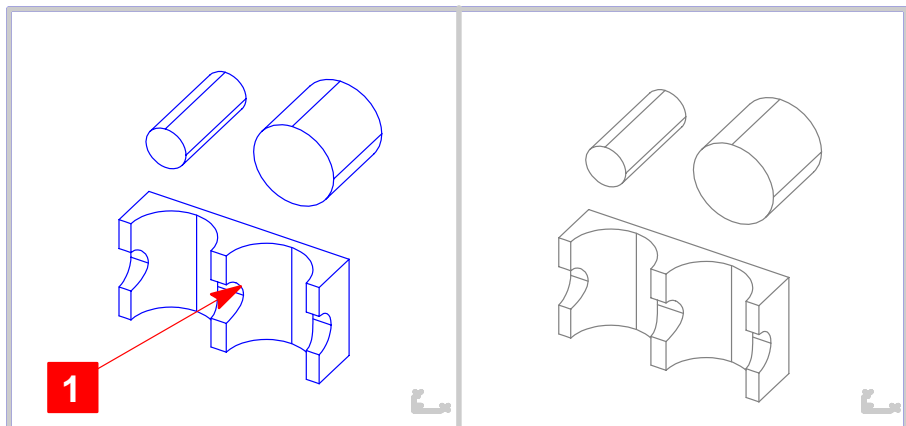
In either case, click twice to select the part or instance instead of picking just the edge or surface.



Deselect All

1

click twice



Check *I-DEAS List*.

The valveblock is listed as: *PT*. Check the other two parts.

Identify the differences between instances and parts

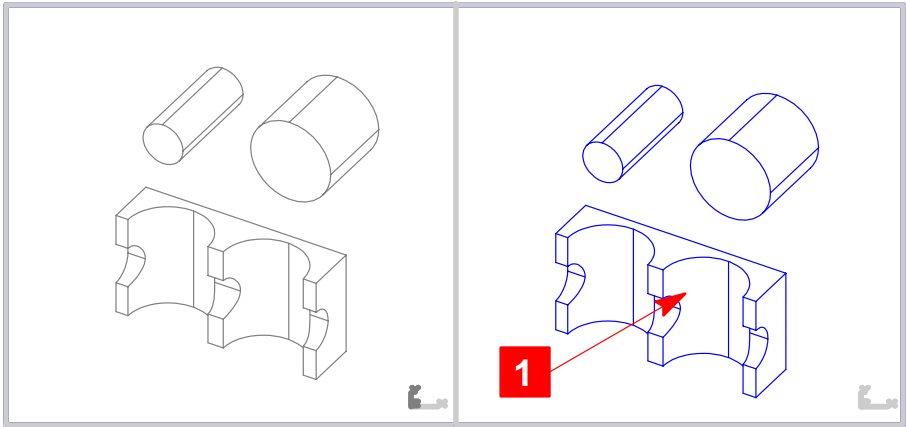
4 of 4



Deselect All

1

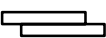
click twice



Check I-DEAS List.

In this viewport, the valveblock is listed as: *IN*.
Check the other two instances.

Recovery Point



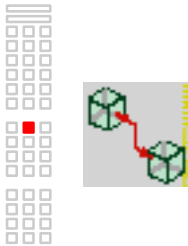
File
Save

Move instances without constraints 1 of 5

An instance inherits the translations and geometry of a part, but not the other way around. In this section you will see what happens when you move an instance compared to moving a part.

Move instances without constraints 2 of 5

While still in the Assembly task, use the *Align* icon to align the piston instance in viewport 2 with the pushrod instance.

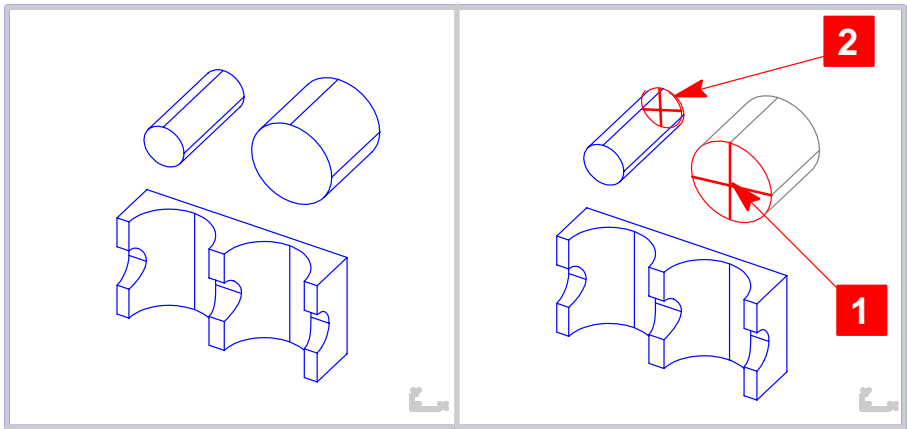


1 pick face of piston

 piston # (select from menu)

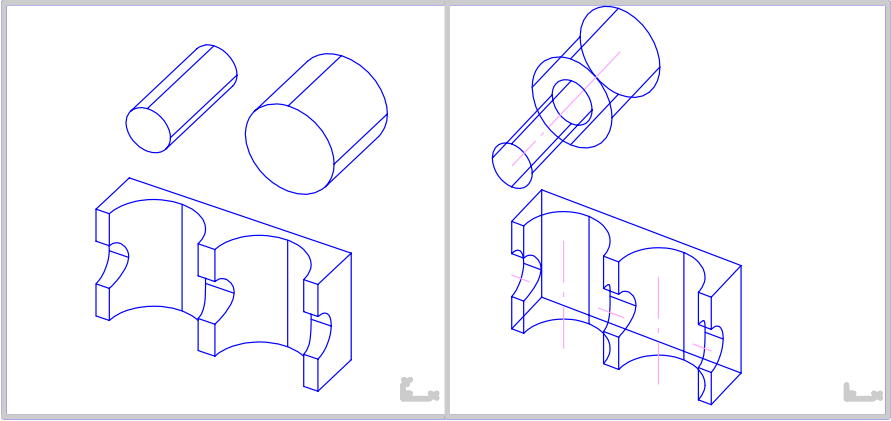
2 pick face of pushrod

 Done



See next page for result

Move instances without constraints 3 of 5

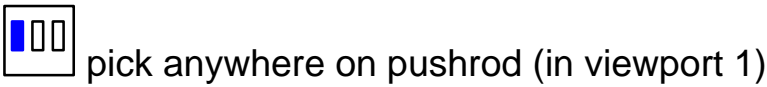
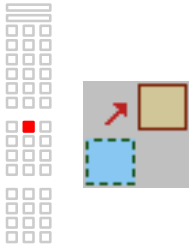


Things to notice

In viewport 1, the parts did not move; only the instances in viewport 2 moved.

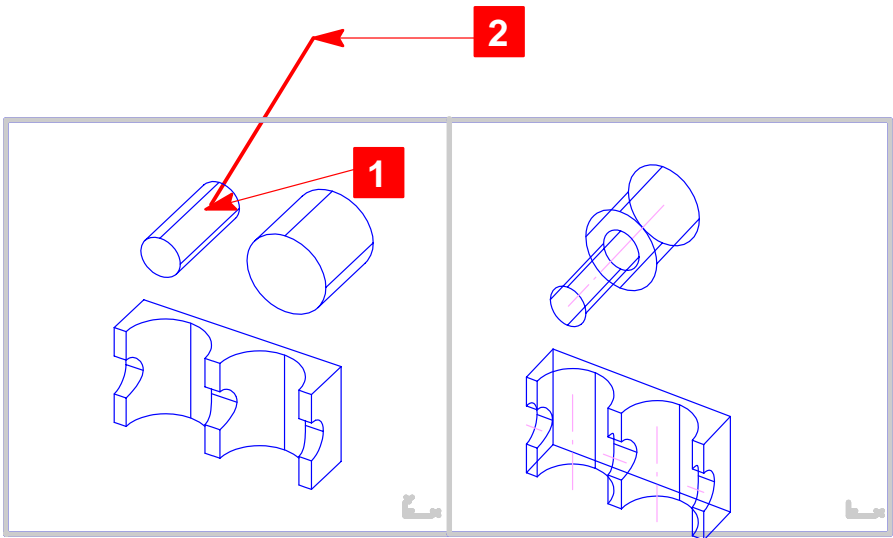
Move instances without constraints 4 of 5

Move the parts in viewport 1.



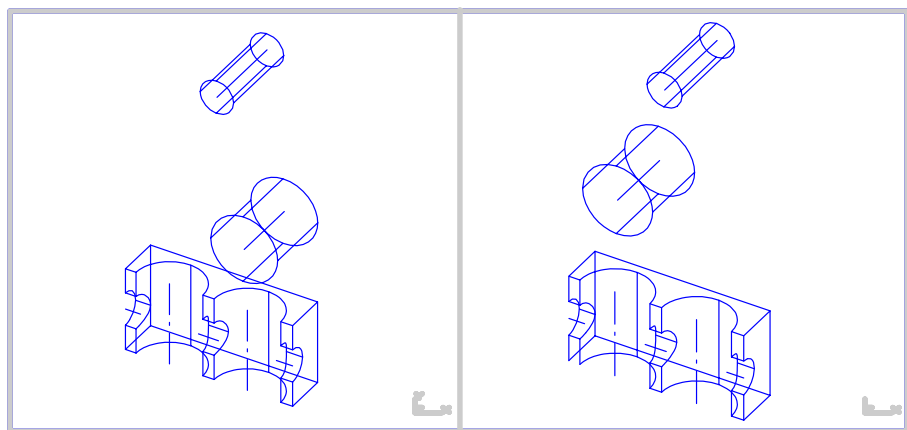
1 click and drag pushrod

2 release mouse button



See next page for result


Move instances without constraints 5 of 5



Things to notice

Both the part and the instance moved. When your part moves, geometry of the instances also move because they are not constrained—they follow along.

Your viewports may be different than the ones shown above.

 Building parts in place and creating assemblies without constraints is a valid design technique. However, you must be careful moving parts because geometry of the instances of that part will also move in the assembly.

Another design technique is to constrain instances, which is discussed in the next section.

In this section you will learn how to constrain instances. It is important to lock instances that should not move. You may also constrain instances in relation to each other.

By using assembly constraints, instances will remain in proper relationship with each other when part dimensions change.

In viewport 2 put away the Valve Assembly and get the Piston Assembly.



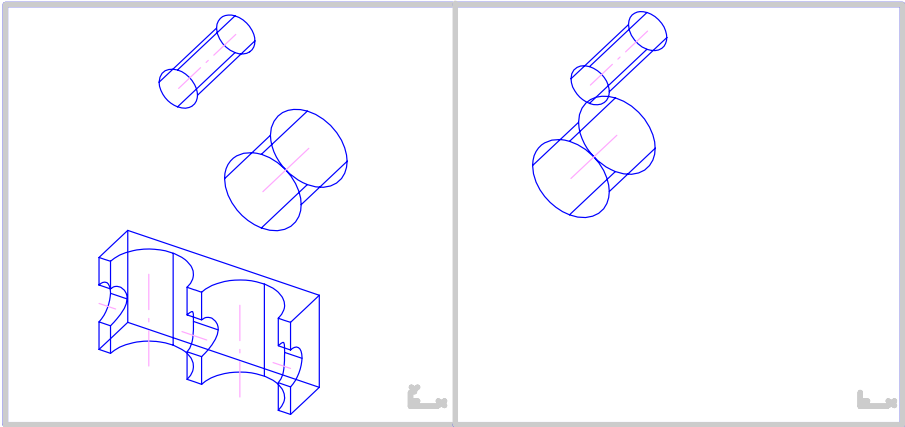
Get form

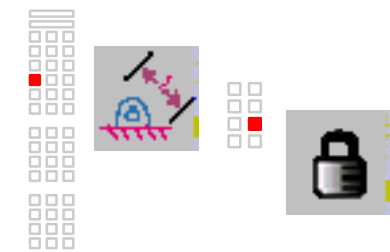


Piston Assembly (select)




OK






Lock the piston in viewport 2.

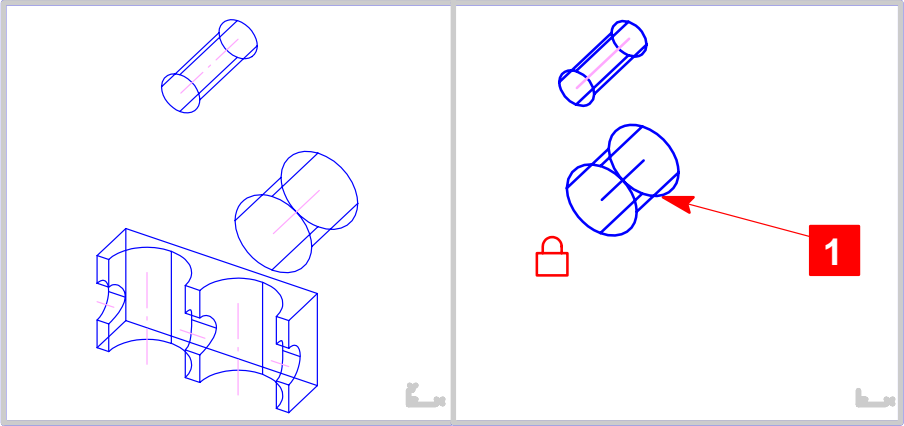
1 pick the piston

 (Accept)

 *Hierarchy...*

Hierarchy Selection form

 Piston Assembly (select)
 OK

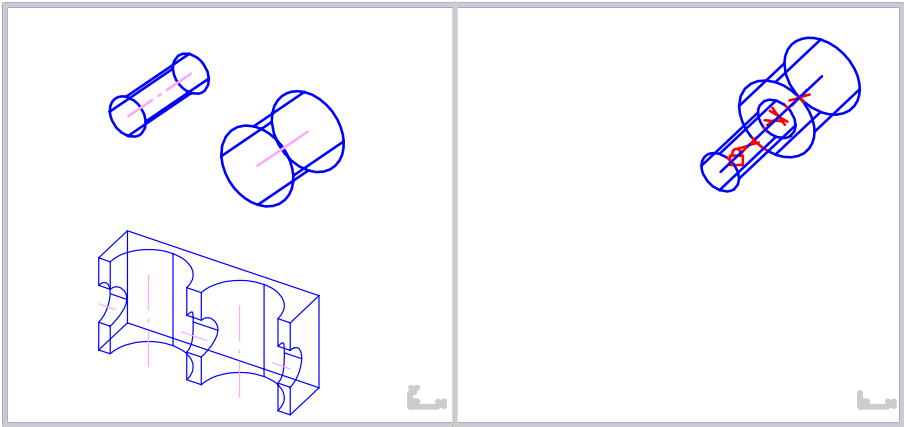
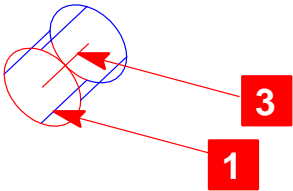
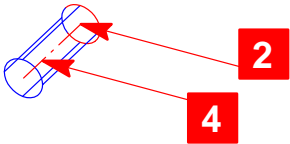


Don't close the Constrain panel.

Next, constrain the pushrod to the piston.



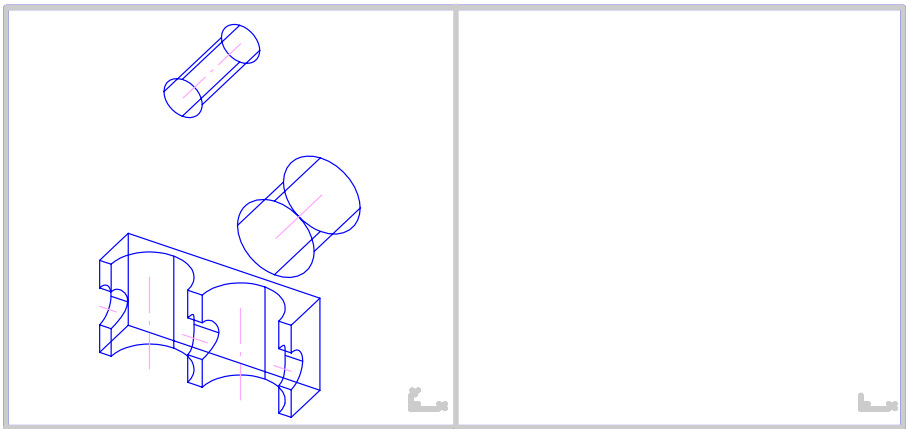
- 1 pick piston face
- 2 pick pushrod face
- 3 pick centerline
- 4 pick centerline



Close the Constrain panel.
Put the Piston Assembly away.



Use the *Redisplay* icon.



Recovery Point



The remainder of the tutorial deals only with assembly instances. To make the graphics display larger and more visible, first reset your display filters, then reset the graphics window to one viewport.



Display Filter form



Viewport 1



Assembly... (toggle on)



Apply



Viewport 1

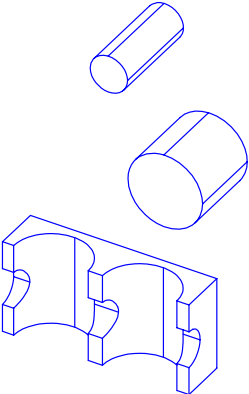
Viewport 2



Parts...(toggle on)



OK



Put away the push rod, valveblock, and piston.



Get form

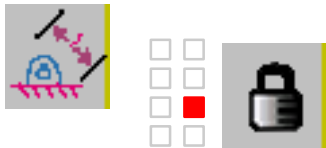


Valve Assembly (select)



OK

Next, lock the valveblock.



1 pick anywhere on valveblock



(Accept)



Hierarchy...

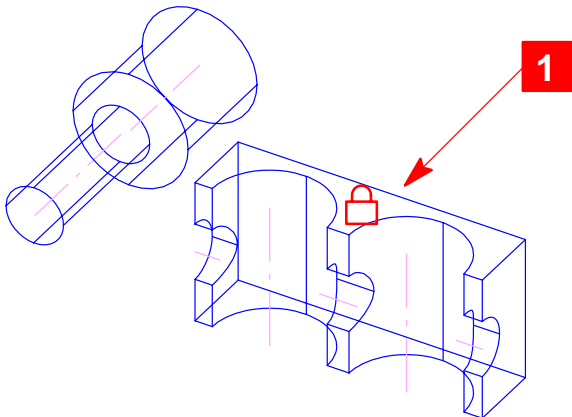
Hierarchy Selection form



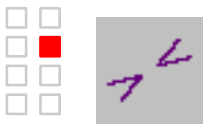
Valve Assembly (select)



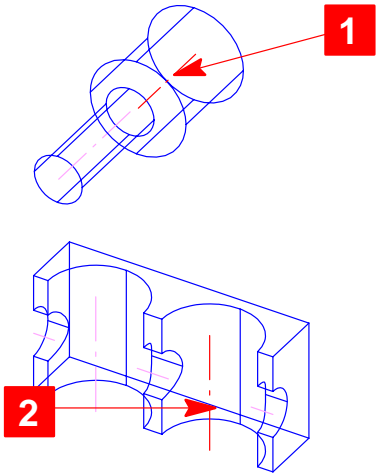
OK




Next, align the piston assembly with one of the holes on the valveblock.



- 1** pick center line in piston
- 2** pick center line in valveblock

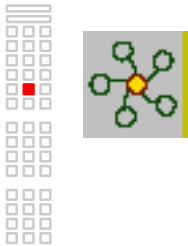


Close the Constrain panel.

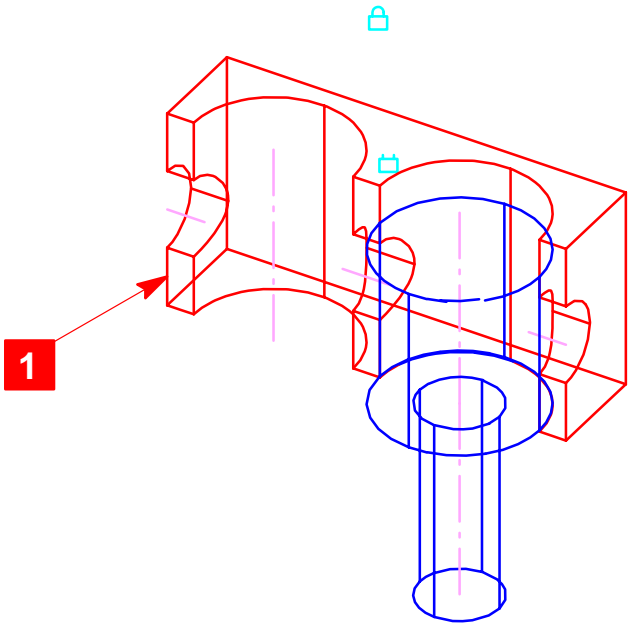
 Use dynamic viewing to move the instances if the pop-up menu obscures your view of the workbench.

Your piston may be pointing up or down. In either case, continue on, as we will correct this situation in the next few steps.

In order to flip the piston you will need to use the *Assembly Relations Browser* form.

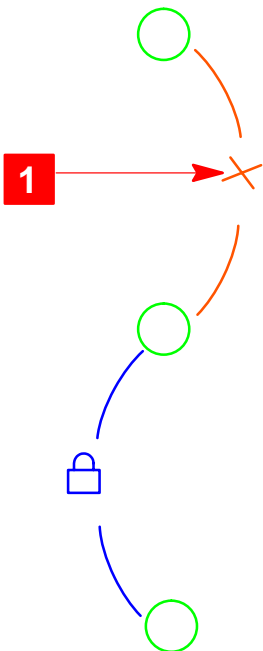


1 Pick the valveblock.



Continued on next page...

Assembly Relations Browser form



1 Pick the coincident constraint on the *Assembly Relations Browser* form.

Things to notice

The constraint you pick on the form is highlighted on the workbench.

Warning!

Don't dismiss the *Assembly Relations Browser* form.

Continued on next page...

Assembly Relations Browser form

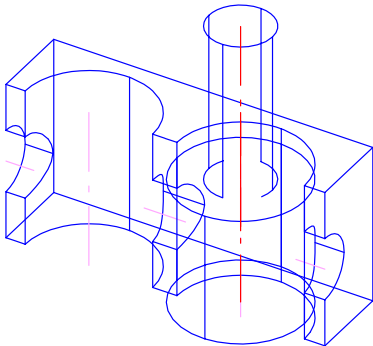


Flip

Flip the piston assembly as required. When the connecting rod is pointing up as shown below, dismiss from the form.



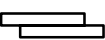
Dismiss



Things to notice

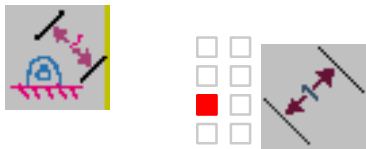
Don't worry if your piston is too high or too low. In the next steps, you will create a dimension which will allow you to position it correctly in the vertical direction.

Recovery Point




*File
Save*

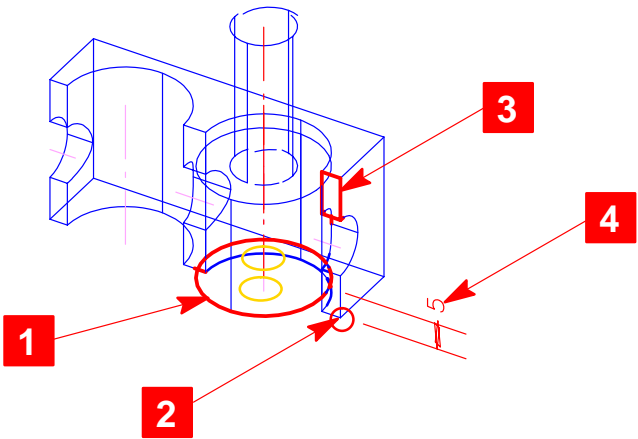
Next, you will add a dimension to the piston, between a plane and a point.



- 1 pick bottom face of the piston
- 2 pick bottom corner valveblock
- 3 pick planar surface on front of valveblock

 (Accept – if necessary)

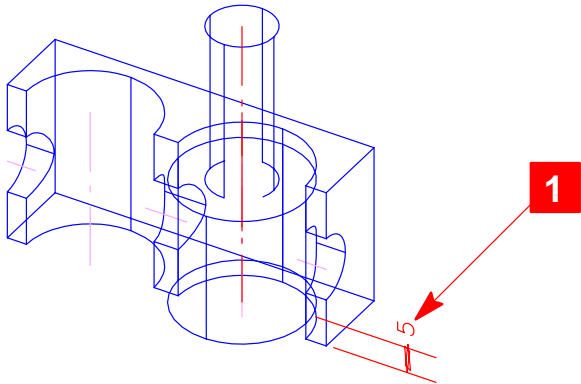
- 4 position the text



 (Done)

Close the Constrain panel.

Modify the dimension to position the piston so that it is 5mm above the bottom of the valveblock.



1



(Done)



5 (If the piston is above the bottom)



-5 (If the piston is below the bottom)

Things to notice Since planes have a positive and negative side, plane-to-point dimensions can be modified to have a negative value. Point-to-point dimensions only have a distance, and cannot be negative. For this reason, a plane-to-point dimension was used here.

Recovery Point



File

Save

When you duplicate instances in an assembly, you are not making a copy of the part in the bin. A copy is a separate and independent part. When you create a duplicate of an instance, you are creating a way to represent a single part more than once.

This is a very valuable function of an assembly because it helps you track how many parts you use and how many parts you have to build.

In this section you will duplicate an instance and add it to the assembly.

To duplicate the piston subassembly, start with the *Hierarchy...* icon.

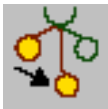


Hierarchy form



Piston Assembly (select)

(click icon on form)



(to accept)

Hierarchy Selection form



Valve Assembly (select)



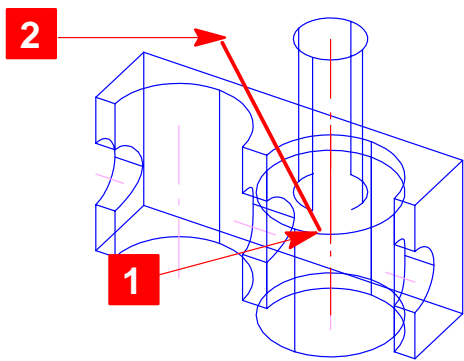
OK

Things to notice

You cannot see the duplicate assembly. I-DEAS has automatically placed the duplicate directly on top of the same instance.

Continued on next page...

Click and hold your left mouse button on the instance and drag the duplicate instance to a new position on the screen.



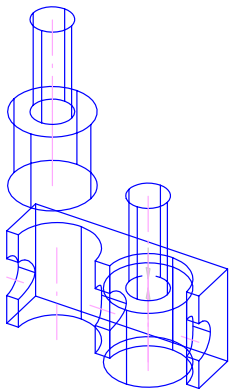
Things to notice

Now there are two piston assemblies listed on the form.

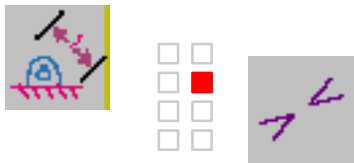
Hierarchy form



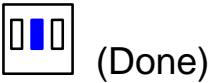
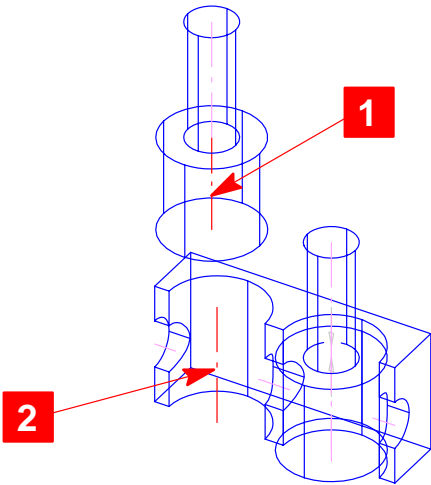
Dismiss




Next, constrain this duplicate subassembly with the other hole in the valveblock.



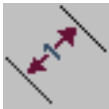
- 1 pick center line in piston
- 2 pick center line in valveblock




(Done)

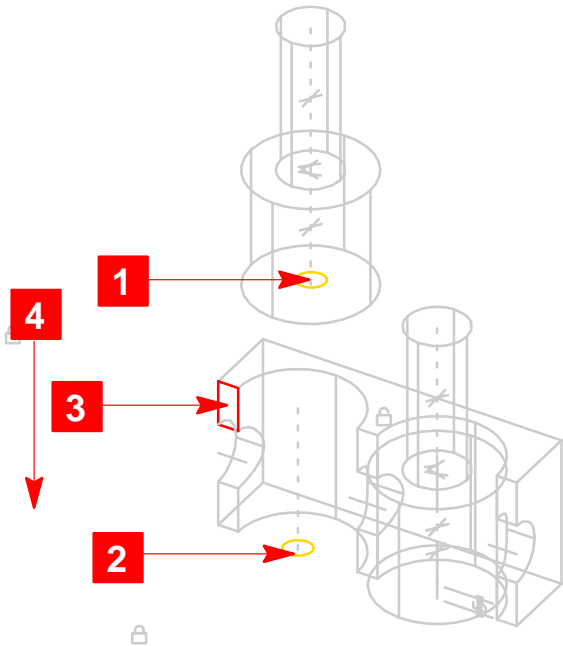
 Use dynamic viewing to move the instances if the pop-up menu obscures your view of the workbench.

Next, you will need to add a dimension to the piston.



- 1 Pick bottom centerpoint in piston.
- 2 Pick bottom centerpoint in valveblock.
- 3 Pick planar surface on front of valveblock.
- 4 place text

 In the first two picks it is very important to select the centerpoints (endpoints), NOT the centerlines.



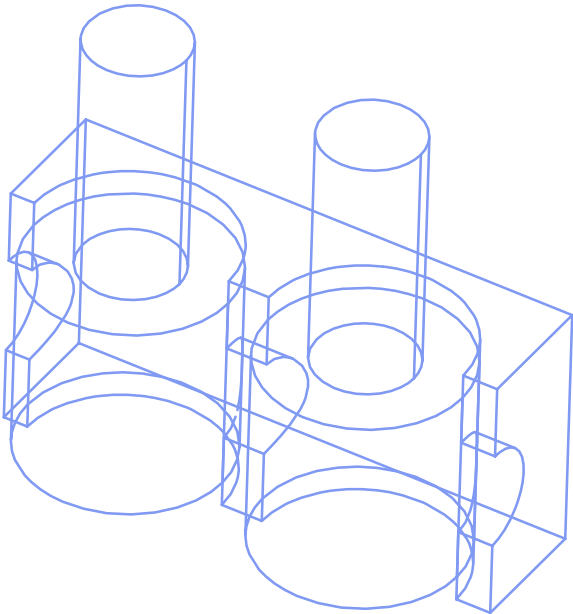
(Done)

Close the Constrain panel.

Modify the dimension to 5mm to position the piston so that it “appears” to be flush with the bottom of the valveblock.



Use the *Redisplay* icon.



Recovery Point



Libraries are used to store parts, drawings, and assemblies, and to allow data sharing among members of a team. In the rest of the assembly tutorials you will use the assembly you have created in this tutorial.

In this section you will check your assembly into a library.

Check an assembly into a library2 of 2

Check the assembly into the Assembly Workshops library.



(Accept Default)

Check-In form



Check-in, do not keep



Library: Assembly Workshops

Things to notice

I-DEAS has automatically assigned your assembly a version number of 1.



OK



Check I-DEAS List.

Note how each part and all assemblies are being checked into the library.



By default, I-DEAS saves your model file every time you do any type of library operation.

Tutorial wrap-up

You have completed the Creating Assemblies tutorial.

Remember

The parts and assemblies you created in this tutorial will be retrieved from the library in later tutorials.